UNITED STATES MARINE CORPS
3D MARINE AIRCRAFT WING
MARINE CORPS AIR STATION MIRAMAR
P.O. BOX 452038
SAN DIEGO, CA 92145-2038

IN REPLY REFER TO:
5830
SJA
APR 2 1 2009

MEMORANDUM FOR THE RECORD

From: Commanding General, Third Marine Aircraft Wing
To: Files

Subj: MODIFICATION TO FINAL ACTION ON COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F/A-18 AIRCRAFT MISHAP INVOLVING BUNO 164017 THAT OCCURRED ON 08 DECEMBER 2008 IN UNIVERSITY CITY, SAN DIEGO, CA

Ref: (a) (b) (6), (b) (7) s InvRpt of 1 Mar 09 w/ end

1. Per the reference, in taking action on the subject investigation, I previously approved the following recommendations:

a. Recommendation 7: That 3d MAW [Marine Aircraft Wing] submits a NATOPS change to the F/A-18 Single Engine Approach and Landing procedure to reconcile it with OPNAVINST 3710.7T that a twin engine aircraft that has lost the operation of one engine will land at the nearest suitable airport.

b. Recommendation 8: That 3d MAW submits an F/A-18A-D NATOPS [Naval Air Training and Operating Procedures Standardization] change to reconcile the difference between the NATOPS guidance for "land as soon as practical" single engine emergencies to match OPNAVINST 3710.7T guidance for a twin engine aircraft that has lost the operation of one engine.

2. Subsequent discussions, to include with the model manager, have developed the consensus that such changes are unnecessary and in fact may have the undesired effect of creating confusion by inserting more variables into the decision-making process.

3. Accordingly, after much discussion and deliberation, Recommendations 7 and 8 of the reference are disapproved and will not be pursued.

(b) (6), (b) (7)(C)

T. G. ROBLING (b) (6),

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FIRST ENDORSEMENT on (b) (6), (b) (7)(C)'s ltr 5830 SJA of 1 Mar 09

From: Commanding General, Third Marine Aircraft Wing
To: Files

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F/A-18 AIRCRAFT MISHAP INVOLVING BUNO 164017 THAT OCCURRED ON 08 DECEMBER 2008 IN UNIVERSITY CITY, SAN DIEGO, CA

1. Having carefully reviewed the subject investigation, the findings of facts, opinions, and recommendations of the investigating officer are approved except Opinions 26 and 27 and Recommendations 4 and 5, which are disapproved.

2. This tragic accident was the result of mechanical failures: first with the right engine, necessitating its precautionary shutdown, then with the fuel transfer system, ultimately causing the left engine to run out of useable fuel despite the presence of ample quantities of fuel in other tanks. Nevertheless, as borne out in the investigation, this tragedy was avoidable; any one of the following could have prevented this incident: more aggressive maintenance procedures; clearer guidance in maintenance publications; improved integration and supervisory oversight within the squadron Maintenance Division; increased training, situational awareness, and better decision-making by the pilot and squadron personnel directing the aircraft from the ground.

3. By all measureable standards, Marine Fighter Attack Training Squadron 101 (VMFAT-101) was performing its mission both safely and satisfactorily prior to this mishap. However, the squadron's leadership failed in a number of areas leading up to and during this incident. Accordingly, I have taken the following steps regarding personnel accountability:

a. I have relieved for cause the following personnel from VMFAT-101: (b) (6), (b) (7)(C) Commanding Officer; (b) (6), (b) (6), (b) (7)(C), Operations Officer; (b) (6), (b) (7)(C), Aircraft Maintenance Officer; and (b) (6), (b) (7)(C), Naval Aviation

Training and Operations Procedures Standardization Officer and Operations Duty Officer at the time of the mishap.

b. The following individuals have received appropriate administrative measures per Chapter 1 of reference (a) for their roles in the mishap: [redacted], the tower representative aboard the ship; [redacted], the Detachment officer-in-charge; [redacted], the Maintenance Material Control Officer; [redacted], the Maintenance Chief; [redacted], the Maintenance Material Control Chief; [redacted], the Maintenance Material Control Officer aboard the ship; [redacted], the Maintenance Material Control Chief aboard the ship; and [redacted].

c. [redacted]'s performance is being addressed separately through the Field Flight Performance Board process.

4. In addition to the corrective actions listed above and contained in Recommendations 6 - 13, the following additional information and recommendations are provided:

a. 3d Marine Aircraft Wing (3d MAW) has formally requested that the Commander, Naval Air Forces/Naval Air Systems Command improve Maintenance Status Panel (MSP) code policy through a three-phased approach:

(a) Short-term: provide interim guidance to clarify MSP code management at the Group/Squadron level;

(b) Mid-term: provide an F/A-18A-D Critical MSP Code List; and

(c) Long-term: conduct a comprehensive review of F/A-18A-D MSP processes and procedures to include F/A-18A-D Mission Essential Subsystem Matrix, Fault Reporting Manuals, and Work Packages associated with the F/a-18A-D fuel system.

b. On 22 January 2009, the Commanding Officer, Marine Aircraft Group (MAG) 11 issued interim MSP management guidance, which provided to all MAG-11 F/A-18 squadrons enhanced policy on critical fuel-system-related MSP codes, standardization of trend analysis programs, and hot-pit and refueling procedures.

c. The Assistant Chief of Staff, Aviation Logistics Division, is directed to conduct a comprehensive review of MAG and squadron "safe-for-flight" certification syllabi and procedures to ensure standardization within 3d MAW and to ensure compliance with governing directives.

d. The Assistant Chief of Staff, Aviation Logistics Division, shall review by-squadron compliance status for Maintenance Control Management Courses, take steps to attain full compliance where deficiencies exist, and coordinate with Headquarters, Marine Corps to improve the quality, effectiveness, and availability of these courses.

e. The Assistant Chief of Staff, G-3, is directed to ensure that all squadrons are conducting drills and training geared toward improving ready room procedures, particularly during in-flight emergencies.

f. I recommend that Headquarters, Marine Corps consider refining its assignment policies to specially select the billet of Commanding Officer, VMFAT-101, even beyond the normal command screening process, to ensure the selected officer possesses the experience, background, and qualities best suited for this particularly large, complex squadron.

g. I also recommend that Headquarters, Marine Corps formally change VMFAT-101's Aircraft Maintenance Officer billet, currently a unrestricted Major, military occupational specialty (MOS) 6002, to a limited duty officer (LDO) billet to reflect Major, MOS 6004. The size, dynamics, and complexity of VMFAT-101 warrant the additional experience and expertise this would bring. The Assistant Chief of Staff, G-1, is directed to initiate a Table of Organization Change Request to this effect.

5. Recommendation 10 is submitted to the Commanding General, Marine Corps Installations West for his consideration. While the overall post-mishap response was well-coordinated and well-executed, I concur that providing Air Station Aircraft Rescue Fire Fighters with communications equipment compatible with local fire departments would enhance their ability to communicate with one another. I recommend reviewing the fielding of equipment not only for Marine Corps Air Station, Miramar, but Camp Pendleton, Yuma, and Twentynine Palms as well.

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F/A-18 AIRCRAFT MISHAP INVOLVING BUNO 164017 THAT OCCURRED ON 08 DECEMBER 2008 IN UNIVERSITY CITY, SAN DIEGO, CA

6. Per reference (a), the Office of the Staff Judge Advocate will retain the original of this investigation for a period of two years.

7. Our deepest sympathies are with the [redacted], [redacted], and [redacted] families and with all those affected.

[redacted]

T. G. ROBLING [redacted]

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CG, MCI-W
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MAR 0 1 2009

From: (b) (6), (b) (7)(C), Investigating Officer
To: Commanding General, Third Marine Aircraft Wing

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F/A-18 AIRCRAFT MISHAP INVOLVING BUNO 164017 THAT OCCURRED ON 08 DECEMBER 2008 IN UNIVERSITY CITY, SAN DIEGO, CA

Ref:
(a) JAGINST 5800.7E, CH 2
(b) Title 10, U.S. Code, Subtitle A, Part IV, Ch 134, Subchapter II, Section 2255
(c) A1-F18AC-NFM-00, F/A-18 A-D NATOPS FLIGHT MANUAL
(d) OPNAVINST 3710.7T
(e) WgO P3710.39B with Change 1
(f) GruO 3710.6L
(g) MCAS Miramar Airfield Operations Manual (AOM)
(h) OPNAVINST 5442.4M
(i) T&R Manual
(j) A1-F18AC-NFM-500, NATOPS Pocket Checklist
(k) MAG-11 Local Addendum to Standard Operating Procedures for USMC F/A-18 Flight Operations
(l) Standing Operating Procedures for USMC F/A-18 Flight Operations

Encl:
(1) CG, 3d MAW ltr 5810 SJA of 12 Dec 08, (b) (6), (b) (7) s ltr 5810 SJA of 30 Dec 08, CG, 3d MAW ltr 5810 SJA of 5 Jan 09, (b) (6), (b) (7) s ltr 5830 SJA of 9 Feb 09, and CG 3d MAW ltr 5810 SJA of 9 Feb 09
(2) Glossary of Acronyms and Terms
(3) VMFAT-101 Initial Mishap Data Report, DTG 090007Z Dec 08
(4) Excerpts from Mishap Pilot (MP) Officer Qualification Record (OQR)
(5) ALNAV 040/08
(6) Excerpts from MP NATOPS Flight Personnel Training/Qualification Jacket
(7) E-mail from (b) (6), (b) (7)(C) dtd 2 Feb 08
(8) Excerpts from MP's Medical Record
(9) Monthly Immediate Action Exam dtd Nov 08

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(10) Excerpts from MP Pilot Logbook
(11) RAC Performance Review Board (RPRB) report
(12) Excerpts from MP Aircrew Performance Record
(13) MS RPRB Order 5420.2
(14) Summary of Interview with [redacted] dtd 19 Dec 08
(15) Summary of Interview with [redacted] dtd 16 Dec 08
(16) Safe for CQ letter dtd 1 Dec 08
(17) Excerpts from NATOPS Landing Signal Officer Manual
(18) Statement of [redacted] dtd 9 Dec 08
(19) CQ Grade Summary
(20) USS LINCOLN Airplan, 8 Dec 08
(21) Photo of MS Ready Room (USS LINCOLN) Flight Status Board
(22) Excerpts from MAC Airframe Logbook and Phase packet
(23) Excerpts from MAC Aircraft Discrepancy Book (ADB)
(24) Excerpts from MAC Engine Logbook
(25) Final Engineering Investigation Reports
(26) Statement of [redacted] dtd 23 Jan 09
(27) Statement of [redacted] dtd 5 Jan 09
(28) F/A-18 C/D MSP Codes Pocket Guide 20X
(29) Summary of interview with [redacted] dtd 26 Jan 09
(30) Statement of [redacted] dtd 29 Dec 08
(31) E-mail from [redacted] dtd 5 Feb 09
(32) Summary of interview with [redacted] dtd 5 Jan 09
(33) Excerpt of Power plants 110 Pass Down Logbook
(34) Organization Maintenance Testing and Troubleshooting, Fuel System, Work Package (A1-F18AE-460-210)
(35) Summary of Interview with [redacted] dtd 22 Jan 09
(36) Excerpts of Crash Survivable Flight Incident Recorder System (CSFIRS) Findings
(37) 502/590/591 30-day Historical findings from SAME Data
(38) Excerpts from NATOPS Flight Manual Navy Model FA-18A/B/C/D
(39) Overview of Maintenance Records Fact-Finding for Mishap, MALS-11
(40) F/A-18 A/B/C/D Mission Essential Subsystem Matrix (MESM) and modifications thereto
(41) USMC F/A-18 Initial Training PowerPoint presentation
(42) VMFAT-101 AMSRR, 8 Dec 08

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(43) Combined AMSRR for MAG-11 REIN
(44) Civilian Contractor Personnel Summary
(45) Statement of [redacted] dtd 27 Jan 09
(46) Statement of [redacted] dtd 13 Jan 09
(47) Summary of Interview with [redacted] dtd 3 Feb 09
(48) VMFAT-101 Category I FRS Syllabus Summary
(49) NAS North Island Airfield Information, AIRNAV.com
(50) Excerpts from Southwest DoD High Altitude Approach Plate
(51) IFR Enroute Supplement
(52) E-mail from [redacted] dtd 26 Jan 09
(53) Statement of [redacted] dtd 17 Dec 08
(54) Summary of follow on interview with [redacted] dtd 17 Dec 08
(55) Excerpts from NATOPS Instrument Flight Manual
(56) FAA SOCAL Approach Audio Transcript
(57) MCAS Miramar Airfield Information, AIRNAV.com
(58) Statements of [redacted] dtd 22 Dec 08 and 9 Jan 09
(59) Statement of [redacted] dtd 17 Dec 08
(60) E-mail from [redacted] dtd 5 Feb 09
(61) Statement of [redacted] dtd 13 Jan 09
(62) Statement of [redacted] dtd 5 Jan 09
(63) Statement of [redacted] dtd 23 Dec 08
(64) Statement of [redacted] (USN) dtd 22 Jan 09
(65) Notice to Airmen (NOTAMs) posted at Squadron Ready Room Desk for NASNI and Miramar
(66) USS LINCOLN (CVN-72) CATCC Audio Transcript
(67) Excerpts from NATOPS Pocket Checklist (PCL)
(68) Excerpts from CV NATOPS Manual
(69) MAG-11 Local Addendum to SOP for USMC F/A-18 Flight Operations
(70) Standard Operating Procedures (SOP) for USMC F/A-18 Flight Operations
(71) VMFAT-101 Local Addendum to USMC F/A-18 SOP and MAG-11 Addendum
(72) Excerpts from OPNAVINST 3710.7T
(73) RADES data printout
(74) Statement of [redacted] dtd 31 Dec 08
(75) Summary of follow up interview with [redacted] dtd 23 Jan 09
(76) Statement of [redacted] dtd 16 Dec 08
(77) Summary of follow up interview with [redacted] dtd 23 Jan 09

(78) Photo of MS Emergency Information Board and MS Ready Room (Miramar) Flight Status Board
(79) Summary of follow up interview with [redacted] dtd 22 Dec 08
(80) Statement of [redacted] dtd 8 Dec 08
(81) Statement of [redacted] dtd 8 Dec 08
(82) Statement of [redacted] dtd 31 Dec 08
(83) Printout of simulator BINGO descent profile and summary of Fuel discrepancy observed in simulator
(84) Weather Observation Reports (ADDS METAR)
(85) MCAS Miramar Tower Audio Transcript
(86) Summary of interview with NAVAIR engineers dtd 2 Feb 09
(87) Photo of tree east of 4419 Cather Avenue
(88) Statement of Fire Chief [redacted] dtd 23 Jan 09
(89) Photos of skid mark vic of 4411/4416 Cather Avenue
(90) Photos of fuselage impact marks
(91) Photo of storage trailer at 4416 Cather Avenue
(92) Photo of right wing impact at 4416 Cather Avenue
(93) San Diego County Medical Examiner Reports
(94) San Diego Police Department Memorandum dtd 31 Dec 08
(95) Photograph of 4406 Cather Avenue
(96) Mishap site diagram
(97) Mishap site notes dtd 08 December 2008
(98) Summary of mishap site notes and photos dtd 9 Dec 08
(99) Maps of debris locations
(100) Summary Notes from [redacted] dtd 6 Jan 09
(101) Summary of interview with [redacted] dtd
(102) Photograph of vehicles at 4371 Huggins Street
(103) Photograph of vehicle at 4370 Huggins Street
(104) Summary of interview with [redacted] dtd 14 Jan 09
(105) Summary of interview with [redacted] dtd 22 Jan 09
(106) City of San Diego Fire Incident Report
(107) E-mail from [redacted] dtd 9 Feb 09
(108) NTSB report of 1999 American Airlines MD-82 Divert into MCAS Miramar
(109) NAVAL AVIATION GENUSE HAZREP, 01-09, 12 JAN 2009-01-30
(110) CO, MAG-11 ltr3500 ASO of 22 Jan 09
(111) Summary of follow up interview with [redacted] dtd 19 Feb 09

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F/A-18 AIRCRAFT MISHAP INVOLVING BUNO 164017 THAT OCCURRED ON 08 DECEMBER 2008 IN UNIVERSITY CITY, SAN DIEGO, CA

(112) Summary of follow up interview with [redacted] dtd 18 Feb 09

(113) Summary of follow up interview with [redacted] dtd 18 Feb 09

(114) Summary of follow up interview with [redacted] Dtd 18 Feb 09

Preliminary Statement

1. The purpose of this report is to provide a comprehensive summary of the investigation into the circumstances surrounding the crash of Marine Fighter Attack Training Squadron One-Zero-One (VMFAT-101) F/A-18D aircraft bureau number (BUNO) 164017 on the morning of 08 December 2008 in University City, in the vicinity of Marine Corps Air Station (MCAS) Miramar, San Diego, California.

2. All reasonably available evidence was collected for this investigation, each directive of the Convening Authority was met, and all governing regulations contained within the references were adhered to. Enclosures (3) through (110) contain factual material evidence pertinent to this investigation.

3. Legal assistance was provided by [redacted], USMC, 3d Marine Aircraft Wing (3d MAW) Staff Judge Advocate (SJA).

4. Eyewitnesses were interviewed at MCAS Miramar, California in person and by telephone, at Naval Air Station (NAS) Lemoore, California in person, and at Naval Air Station Patuxtent River and Naval Base Bremerton, Washington by telephone. No difficulties were encountered while interviewing witnesses.

5. All social security numbers were obtained from administrative sources. Prior to questioning witnesses, they were advised of their rights under the privacy act in accordance with Paragraph 0523, reference (a), and consented to answer questions.

6. Flight data from the aircraft was reconstructed from the Crash Survivable Flight Incident Recording System (CSFIRS), which was recovered from the aircraft wreckage.

7. All times in this report are local Pacific Standard Time (PST) unless otherwise annotated.

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8. Original items of evidence are in the custody of the VMFAT-101 Aircraft Mishap Board (AMB). The senior member of the AMB is [redacted], USMC, DSN [redacted].

9. This investigation complies with U.S. Code Title 10, subtitle A, Part IV, Chapter 134, subchapter II, §2255 (Aircraft Accident Investigation Boards). The investigating officer (IO), [redacted], is a designated Naval Aviator, the Command Inspector General of 1st Marine Expeditionary Force (3d MAW higher headquarters), and possesses extensive investigative experience and training. The IO consulted with and was assisted in this investigation by [redacted], from Marine Aircraft Group 11 and [redacted], from 4th Marine Aircraft Wing as F/A-18 subject matter experts. Both assistants are also designated Naval Aviators and have prior experience investigating aircraft mishaps.

10. The MAC Maintenance Status Panel (MSP) codes and CSFIRS data were downloaded and decoded by [redacted], Mishap Response and Flight Controls team, NAVAIR, F/A-18 Fleet Support Team. [redacted] provided engineering investigation analysis and aircraft system technical expertise.

11. An extension to this investigation's due date of 8 January 2009 was requested on 30 December 2008 and granted on 5 January 2009 due to delays in acquiring physical evidence and the volume of evidence and data analysis required for this investigation. A second extension was requested on 6 February 2009 and granted on 8 February 2009 for a new due date of 11 February 2009. After 11 February 2009 a final extension was granted to 01 March to conduct follow-on interviews. Enclosure (1) contains the original appointment and subsequent extensions. No other delays or difficulties were encountered in conducting this investigation.

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Findings of Fact

A. The Mishap Pilot (MP)

1. On the morning of 08 December 2008, then [redacted], USMC, the Mishap Pilot (MP), ejected from his F/A-18D aircraft while on a single engine emergency divert from a carrier qualification (CQ) training event, attempting an emergency landing at MCAS Miramar. [encl 3]

2. The MP is on active duty in the Regular Marine Corps, with an active duty base date of 10 December 2004. [encl 4]

3. The MP was selected for his present grade by the Fiscal Year 2009 USMC Captain Selection Board, announced on 16 May 2008 in ALNAV 040/08. He was promoted to Captain on 01 January 2009. [encls 4,5]

4. The MP is an unmarried 28-year old male with a birth date of [redacted] [encl 4]

5. The MP resides at [redacted], telephone [redacted]. [encl 4]

6. The MP was designated a Naval Aviator on 21 November 2007, after completion of advanced flight training in T-45C aircraft with Naval Aviation Training Squadron 21 (VT-21). [encl 6]

7. The MP completed advanced jet flight training with an overall composite score of 278.21, above the average of 207.2. [encls 6,7]

8. The MP reported to the mishap squadron (MS) for CAT I replacement pilot (RP) training on 08 January 2008. [encl 4]

9. The MP was Naval Aviation Training and Operating Procedures Standardization (NATOPS) qualified in F/A-18A-D model aircraft on 08 April 2008, which was valid through 30 April 2009. [encl 6]

10. The MP completed his annual flight physical on 16 October 2008, making it valid until 31 October 2009. [encls 6,8]

11. The MP had a current medical "up-chit" with an expiration date of 31 October 2009 certifying his medical clearance for aviation duty. [encl 6]

12. The MP had a waiver granted for Photorefractive Keratectomy (PRK) on 05 October 2004. [encl 8]

13. The MP's water survival training was current and valid until 31 December 2009. [encl 6]

14. The MP's physiology training was current and valid until 31 December 2009. [encl 6]

15. The MP's ejection seat/egress training was current and valid until 28 February 2009. [encl 6]

16. The MP's standard instrument rating was current and valid through 31 May 2009. [encl 6]

17. The MP completed annual Operational Risk Management (ORM) and Crew Resource Management (CRM) training on 27 February 2008. [encl 6]

18. The MP completed the monthly emergency procedures exam, which was valid through 15 December 2008. [encl 9]

19. The MP had 17.9 flight and 9.0 simulator hours in the 30 days prior to the mishap, and 79.7 flight and 56.3 simulator hours in the 180 days prior to the mishap. [encl 10]

20. The MP had flown 364.2 hours in military aircraft with 107.6 hours in the F/A-18. [encl 10]

21. The MP had received a "Signal of Difficulty" (SOD) on 08 October 2008 during the Basic Fighter Maneuvering (BFM) phase of training in the MS for violating training rules by flying below the briefed minimum altitude ("busting the hard deck"). [encls 11,12]

22. The MP received a second SOD in the BFM phase on 15 October 2008 for loss of situational awareness to flight path deconfliction (near mid-air collision). [encls 11,12]

23. In the MS, a Replacement Aircrew (RAC) Progress Review Board (RPRB) shall be convened for an RAC receiving two SODs in a single phase of training. [encl 13]

24. The MS convened an RPRB for the MP on 20 October 2008. [encl 11]

25. In the MS, a Human Factors Board (HFB) will be convened prior to convening an RPRB. [encl 13]

26. The MS convened a HFB on the MP prior to the RPRB. [encl 11]

27. The HFB "found no issues that would affect the MP's training." [encl 11]

28. The RPRB cited lack of preparation as a contributing factor in the MP's performance in the BFM stage, and concluded that the MP had "demonstrated an attitude of arrogance that may be attributed to his above average performance to date." [encl 11]

29. The RPRB recommended that the MP be administered academic periods of instruction, a warm-up to establish currency, and a refly of the SOD flight with the phase standardization instructor pilot. [encl 11]

30. The MS CO favorably endorsed the RPRB's recommendations on 20 October 2008. [encl 11]

31. The MP completed the stage with no further difficulty. [encl 12]

32. The MP had previously flown out of NASNI in the T-45 while with VT-21. [encls 10,14]

33. Two weeks prior to the MF, the MP had flown an uneventful actual single engine approach and landing into Miramar at night with an 800 foot ceiling with the left engine shut down for an oil pressure caution. [encl 14]

34. At the time of the mishap, the MP was in the final stages of his F/A-18 RP training, with only carrier qualification (CQ) and fighter weapons phases remaining. [encl 12]

35. The MP had completed the carrier qualification (CQ) simulator syllabus, flying simulated normal and emergency approaches into NASNI. [encls 12,14,15]

36. The MP had completed all required Field Carrier Landing Practice (FCLP) flights. [encl 12]

37. MP was certified "safe for CQ" by the MS Commanding Officer. [encl 16]

38. CAT I RPs require ten day arrested landings and six night arrested landings to complete F/A-18 initial CQ. [encl 17]

39. The MP had completed eight of ten required day arrested landings and six of six required night arrested landings as of 07 December 2008. [encls 10,12]

40. The MP had flown two CQ sorties in the MAC on 07 December 08 in which he completed one day and two night arrested landings. [encls 10,18,19]

41. The MF was on the carrier air plan on 08 December 2008 with an 11:00 cycle time. [encl 20]

42. The MS ready room (aboard ship) flight board had the MP assigned to aircraft #253 (the MAC) for the 11:00 cycle time. [encl 21]

43. The MP was on track to earn the "top hook" award for the best CQ grades in his class. [encl 15]

B. The Mishap Aircraft (MAC)

44. The MAC, a Lot 12 F/A-18D, entered original service with the MS on 30 April 1990. [encl 22]

45. The MAC had flown 7,472.3 hours since it entered service. [encl 22]

46. The last scheduled inspection performed on the MAC was a 30 hour inspection which focuses on the engines, Airframe Mounted Accessory Drives (AMADs) and oil system, and was conducted aboard the ship on 07 December 2008. [encl 23]

47. The last phase inspection was a phase "A" completed on 21 August 2008. [encl 22]

48. The MAC had no external wing tanks, external stores, or ordnance at the time of the MF. [encl 23]

49. The MAC's left engine:

a. Was received ready for inspection (RFI) after rework from Marine Aircraft Logistics Squadron Eleven (MALS-11) on 27 November 2007;

b. Had no outstanding Maintenance Action Forms (MAFs). [encl 24]

50. Post-mishap engineering investigation analysis on the left engine concluded that there was no evidence of a hardware or control system failure that would have resulted in an engine flameout. [encls 25,26]

51. Post-mishap engineering investigation analysis on the left motive flow boost pump and left engine fuel boost pump, including their single common impeller determined that they were operating normally during the MF. [encls 25,26]

52. Post-mishap engineering investigation analysis on the Tank 1 turbine transfer pump and Tank 2 fuel boost pressure turbine pump determined that they were operating normally during the MF. [encls 25,26]

53. Post-mishap engineering investigation analysis on the left AMAD determined that it was operating normally during the MF. [encls 25,26]

54. The MAC's right engine:

a. Was received RFI from Aircraft Intermediate Maintenance Department (AIMD) Oceana, VA on 09 June 2006;

b. Had no outstanding MAFs. [encl 24]

55. Post-mishap engineering investigation analysis on the right engine concluded that there was a slow drop of oil pressure and no apparent transducer or indicator failure. [encls 25,26]

56. The MAC did not have any ordnance or chaff/flare expendables on board. [encl 23]

57. The MAC had two outstanding MAFs at the time of the mishap. [encl 23]

58. One of the two outstanding MAFs was for inoperative fuel dump system (aircraft system that removes excess fuel by "dumping" overboard via pressurized flow to adjust gross weight to a lower weight) that read "Aircraft will not dump fuel when dump is selected," and was initiated on 06 December 2008. [encl 23,27]

59. No corrective action was indicated on the MAF and the individual exercising safe-for-flight authority requested aircrew check the fuel dump system on the next flight. [encls 23,27]

60. On the next flight on 07 December 2008, aircrew reported that the fuel dumped, but was dumping "very slowly." Maintenance control consulted with Power Plants on the ship and decided this was not a downing discrepancy. [encl 27]

61. The MAC flew two flights on 07 December 2008 after the initiation of the fuel dumping MAF, and one (the MF) on 08 Dec 2008. [encls 10,23]

62. The second of the two outstanding MAFs was for improper left wing fuel tank transfer and was initiated on 14 July 2008. [encl 23]

63. The fuel transfer MAF stated "L internal wing tank would not transfer below 300# until total fuel state was 4500#. Extending probe and cycling bleeds did not aid in transfer. [Right] internal wing tank was at 20#. Unable to conduct OCF [out of control flight] with fuel split [wing fuel tanks transferring unevenly]. MSPs [Maintenance Status Panel (codes)]: 510, 843, 591, 500, 469, 998, 499, 503, 110." [encl 23]

64. MSP codes related to the wing fuel transfer MAF are:

MSP code 591 indicates "L motive boost pump or boost press sw fail."
MSP code 500 indicates "R diverter valve fail."
MSP code 469 indicates "Tank 1 motive system fail."
MSP code 499 indicates "L diverter valve fail."
MSP code 503 indicates "Tank 3 jet level sensor fail."
[encl 28]

65. (b) (6), (b) (7)(C), MS Aircraft Maintenance Officer (AMO), and (b) (6), (b) (7)(C), MS Maintenance Material Control

Officer (MMCO) stated there previously was a Naval Air Systems Command (NAVAIR) program that published a monthly summary analysis of MSP codes. The program was cancelled about six months ago. [encls 29,30]

66. There is no approved NAVAIR list of downing MSP codes or series of codes published or in use for the F/A-18A-D. [encls 29,31]

67. Although there is no current guidance on using MSP codes individually or in sequences to dictate specific maintenance action, Boeing and NAVAIR engineers stated in interviews that:

a. Prior to the MF, NAVAIR Engineers did not realize that USMC F/A-18 maintenance departments did not, in their judgment, lend sufficient weight to MSP codes in judging airworthiness;

b. MSP codes are self-diagnostic indicators of system or system self-monitoring failures and hence should be used to direct and refine maintenance troubleshooting; and

c. This issue is important enough to the engineers to initiate discussion aimed at developing an MSP code criticality and/or reliability list to provide the operators an aid in maintenance.
[encl 31]

68. On 25 September 2008, (b) (6), (b) (7)(C), a civilian contractor working in the Power Plants division, recommended to (b) (6), (b) (7)(C) of Maintenance Control to remove and replace the left motive flow boost pump and the left boost inlet pressure transducer. According to (b) (6), (b) (7)(C), although the work package publications were vague and did not present a clear diagnosis or solution, the incremental replacement of these two parts would have allowed for assessment and possible isolation of the cause. [encl 32,33]

69. Based on the fact that there was no clear or definitive guidance from maintenance publications, (b) (6), (b) (7)(C) declined to have the aircraft placed in a "down" condition to perform the recommended work at that time and instead directed that it be noted and performed at a later time. (b) (6), (b) (7)(C) believes this type of issue would likely have not been brought to the AMO's attention. Quality Assurance Division was never consulted. [encls 32,47,111]

70. The Power Plants division maintenance passdown log dated 25 September 2008 reads "M/C (maintenance control) wanted us to troubleshoot L internal wing slow to transfer. Low powered A/C (aircraft) and found left motive flow system has low pressure in tanks 1, L wing, and L feed pressure. We troubleshot down to R/R (remove and replace) L MFBP (motive flow boost pump) and L MFBP pressure switch. Also, the electric shop needs to R/R L feed pressure transducer due to incorrect reading and MMP [MSP] 591. Once we [notified] M/C they told us not to work on it. Whenever M/C lets us work on it, we need to cut a MAF to electric shop to R/R L feed press[ure] transducer. L wing transfer test [checks] 5.0. Need to change those part[s] whenever control is ready." [encl 33]

71. The AMO and MMCO stated they would typically want to know about a question such as this where the maintenance publications do not provide definitive guidance and would want to weigh in on this type of decision on whether to continue the maintenance. [encls 29,30]

72. There is no defined pressure range or lower limit associated with the maintenance work package troubleshooting MSP code 591 (L motive L motive boost pump or boost press sw fail). There is no limitation listed that dictates a pass/fail test or that defines an up or down status as a result of troubleshooting steps. [encls 33,34]

73. Naval Air Systems Command (NAVAIR) engineers began work on another MS aircraft after the mishap to analyze similar MSP codes and associated maintenance work packages. It was concluded that work package 460-210 is deficient in identifying the cause of the MSP code occurrence. [encl 26,111]

74. As a result of this mishap, NAVAIR is conferring with the manufacturer to create an MSP code criticality list to aid the operational units in maintenance. [encl 26,31]

75. The MSP codes from the flight previous to the MF included:

a. 502: "Tank 2 Jet Level Sensor Failure;" and

b. 591: "L (left) Motive Flow Boost Pump or Boost Pressure Switch Fail"

[encl 28,36]

76. Historical data from all nine flights in September and all 24 flights in October indicate the occurrence of MSP code 591. [encl 37]

77. The Tank 2 jet level sensor valve requires a minimum of 10 psi left motive flow boost pressure to operate properly. Below 10 psi triggers an MSP code, and below 3 psi the valve ceases to function. [encls 26,38]

78. The maintenance supervisory chain, up to and including the MS AMO, were never specifically advised of the fuel transfer problems with the MAC. However, the MS AMO signed the MAC phase "A" phase packet on 10 September 2008. The form states that all MAFs have been screened. [encls 22,29]

79. The Mission Essential Subsystem Matrix (MESM) states which aircraft systems/subsystems are required for the aircraft to be mission capable (MC), partial mission capable (PMC), or non-mission capable (NMC). [encl 40]

80. The MESM reads that maintenance will "assign alpha character (Z) when the following system(s)/condition(s) prevent the aircraft from being safely flyable. The aircraft is not capable of day VMC field flight operations with two-way radio communication and necessary aircraft and crew safety provisions. The aircraft is NMC, M or S [Maintenance or Supply]." [encl 40]

81. The MESM lists the "fuel system" as one of the (Z) coded systems that dictate an aircraft to be categorized NMC for any system failures/discrepancies that render it not safe for flight. [encl 40]

82. No parts were ordered against the wing fuel transfer MAF and it was never "Z" coded. [encls 23,29,30,39,40,111]

83. The MAC flew 146 flights and 166 flight hours between the initiation of the left wing fuel tank transfer MAF and the MF. [encl 35]

C. The Mishap Squadron (MS)

84. The MS is one of three Naval Aviation FRSs organized and equipped to train Navy and Marine Corps F/A-18 replacement aircrew (RAC). [encl 41]

85. The three F/A-18 FRSs are combined Navy/Marine Squadrons and train both Navy and Marine aircrew. [encl 41]

86. The MS had 44 total F/A-18 aircraft assigned on 08 December 2008, including F/A-18A/B/C/D models. [encl 42]

87. A Fleet Marine Corps F/A-18 squadron is assigned 12-18 aircraft. [encl 43]

88. The MS utilizes civilian contract maintenance personnel and contract simulator instructors (CSIs). [encls 44,45,46]

89. The MS maintenance department contract maintainers work alongside uniformed personnel. [encls 29,30,32]

90. Contract maintainers provide continuity to the maintenance department, and are considered some of the most experienced maintenance personnel in the squadron. [encls 29,30,47]

91. Power plants division has some of the least experienced military personnel in the maintenance department, according to the MMCO. [encl 30]

92. A new MMCO checked into the MS on 23 June 2008. [encls 29, 47,111]

93. At this time the MS had a total of nine aircraft awaiting phase maintenance, with two aircraft "sidelined" (no flyable hours remaining), until completion of phase. The new MMCO was able to get the phase maintenance program effective and on track within a few months, eliminating the backlog. [encls 29,47,111]

94. The FRS pilot syllabus contains four phases of training: Familiarization (FAM), Air-to-Ground, Air-to-Air, and CQ. [encl 12]

95. CAT I RPs receive 14 FAM simulator sorties during an F/A-18 CAT I syllabus. [encl 12]

96. FAM simulator sorties train the RP in normal and emergency ground and flight procedures including instrument flight training. [encl 48]

97. The FRS CQ simulator phase contains eight training sorties with emergency procedures that include single engine emergency

divert to land-based airfields under instrument flight rules (IFR) and in instrument meteorological conditions (IMC). [encls 12,48]

98. During the familiarization phase of training, MS military and contract simulator instructors (CSIs) address single engine operations including the NATOPS notes, warnings, cautions, and emergency procedures. [encls 45,46,48]

99. The MS CQ Detachment Officer in Charge (Det OIC) instructed the CQ students not to open the Pocket Checklist (PCL) when flying in the carrier pattern gear down and low altitude in order to concentrate on aviating, navigating, and communicating. They were told the shipboard squadron representative in the tower (tower representative or MS TR) would read NATOPS and ensure checklist items were complete. [encl 15]

D. AIRCRAFT SYSTEMS

100. There are six internal fuel tanks in the F/A-18D aircraft numbered from forward to aft and contain the following maximum fuel quantities:

Tank 1	2150 pounds
Tank 2	1790 pounds
Tank 3	1400 pounds
Tank 4	3620 pounds
Left Wing	580 pounds
Right Wing	580 pounds

[encl 38]

101. Tanks 1 and 4 transfer to Tanks 2 and 3 which feed the left and right engine respectively. [encl 38]

102. The left wing tank transfers to Tank 2 and the right wing tank transfers to Tank 3. [encl 38]

103. The primary fuel transfer method is via a transfer manifold that is pressurized by "motive flow," which is fuel pressure created by the two engine-driven fuel boost pumps. [encl 38]

104. The feed tanks (Tanks 2 and 3) each contain one jet level sensor valve that relies on left and right motive flow pressure respectively to operate. [encl 38]

105. When feed tank fuel quantity recedes below a properly operating jet level sensor valve, the valve opens to allow fuel to transfer into the feed tanks. [encl 38]

106. When motive flow pressure is not available, secondary fuel transfer is accomplished via gravity transfer, which is much slower than normal pressurized transfer. [encl 38]

107. Tank 4 will gravity transfer fuel into tank 3, and tank 1 will gravity transfer fuel into tank 2. [encl 38]

108. The feed tanks will gravity transfer into each other via the interconnect valve. [encl 38]

109. The interconnect valve will close, preventing gravity transfer, when an inoperative engine is being "cranked" ("crossbled" or turned using bleed air pressure) via the engine crank switch. [encl 38]

110. Depressing the FIRE light while cranking an engine allows the interconnect valve to re-open, allowing fuel to gravity transfer from the inoperative engine feed tank. [encl 38]

111. Each engine has an airframe mounted accessory drive (AMAD) that powers the AMAD oil system, the fuel boost pump, hydraulic pump, and generator. [encl 38]

112. AMAD oil is cooled by circulating fuel through a heat exchanger system, warming and circulating the fuel while cooling the oil. [encl 38]

113. Fuel is circulated through the internal wing tanks to cool the fuel to avoid overheating. [encl 38]

114. The "FUEL LO" caution light illuminates when there is approximately 800, plus or minus 100, pounds of fuel remaining in the affected fuel feed tank. [encl 38]

115. When the fuel quantity in either feed tank (Tank 2 or 3) drops below 800 pounds plus or minus 100 pounds the fuel system stops circulating fuel to the internal wing tanks to preserve the remaining quantity of fuel in the feed tank. [encl 38]

E. Naval Air Station North Island (NASNI) vs. Miramar Comparison

116. NASNI has a maximum available runway (RWY) length of 8,000 feet, and short and long field, bi-directional arresting gear available on RWYs 36/18, and 29/10. [encls 49,50,51]

117. NASNI has a Tactical Air Navigation aid (TACAN) with distance measuring equipment (DME). [encls 50,51]

118. The long-field arresting gear on RWY 36 is typically de-rigged except when NASNI is the primary divert field for carrier operations. [encls 49,52]

119. NASNI was the CQ primary divert airport on 08 December 2008 and all arresting gear were rigged and in battery. [encl 52]

120. NASNI has non-precision and precision approaches to RWY 36. [encls 49,50]

121. There was no MS LSO support at NASNI for divert aircraft during this CQ period. [encls 53,54]

122. The visual approach to RWY 36 keeps approaching aircraft over the water until shortly before touchdown. [encl 50]

123. The missed approach (wave-off) from RWY 36 calls for a climbing right turn to 2,000 feet. [encl 50]

124. Any aircraft flying at 150 KTS and using 20 degrees angle of bank would have a radius of turn of .8 NM. San Diego Lindbergh International Airport is 2.0 NM from the midpoint of NASNI, and 1.8 NM from the departure end of RWY 36. Downtown San Diego is 2.5 NM from NASNI. [encls 49,55]

125. The weather at NASNI at the time of the divert was 2,500' scattered, winds 100/08 (scattered cloud deck at 2,500 feet, winds from 100 degrees at 8 KTS). [encl 56]

126. The visual approach to RWY 36 was available and offered to the MP by the FAA controller. [encl 56]

127. Miramar has a maximum available runway length of 12,000 feet, short and long field bi-directional arresting gear on RWYs 06L, 06R, 24L and 24R.[encls 50,51,57]

128. The short-field arresting gear on RWY 24R (long-field gear on RWY 06L) is typically de-rigged. [encl 57]

129. Miramar has precision and non-precision approaches to RWY 24 and a non-precision approach to RWY 06L. [encls 50,57]

130. Miramar is the MS's home base. [encl 40]

131. Miramar had a MS LSO immediately available during the MF. [encls 53,54,58,59]

132. There is no published missed approach for RWY 06L [encls 50,60]

133. The nearest airport to MCAS Miramar is Montgomery Field, which is approximately 3.0 NM to the south. [encl 57]

134. The MS had three mission capable F/A-18 aircraft staged at NASNI on 08 December 2008 available for CQ missions. They flew into NASNI on Friday, 05 December 2008, staged as spare CQ aircraft for the weekend due to weekend airfield hours at Miramar. They had fresh daily inspections and the MS had a maintenance turn crew available during the weekend as needed. The MS Tower Rep was not aware of these aircraft. The MS Det OIC was aware they were there as CQ spares over the weekend, but not of their availability on Monday, 08 Dec 2008. [encl 41,111,112,113,114]

F. The Mission

(1) Preflight Data

135. The MP was part of a six-plane squadron CQ detachment aboard the Aircraft Carrier USS Abraham Lincoln ("ship"). The detachment was joined by other FRS detachments to conduct initial CQ training for RPs. [encl 15]

136. The MS Det OIC aboard the ship was (b) (6), (b) (7)(C) (b) (6), (b) (7)(C), a squadron landing signal officer (LSO) and instructor pilot. [encl 15]

137. The MS tower representative (TR) aboard the ship at the time the MP took off was (b) (6), (b) (7)(C), USMC, a MS instructor pilot. [encl 61]

138. The designated FRS Carrier Air Group Commander (RAG CAG) for the CQ det aboard the ship on 08 December 2008 was (b) (6), (b) (7)(C), USN. [encl 62]

139. The ship's "Air Boss" was (b) (6), (b) (7)(C), USN, who was present in the ship's tower during the MF. [encl 63]

140. The Captain of the ship on 08 December 2008 was (b) (6), (b) (7)(C), USN. [encl 64]

141. The MP flew aboard the ship on 05 December 2008. [encls 10,14]

142. The MP had flown four CQ sorties prior to the MF: one each on 05 and 06 December 2008 and two on 07 December 2008. [encls 10,14]

143. The primary divert field on 08 December 2008 was briefed as NASNI. [encls 61,62,64,65]

(2) Catapult/MF Commencement

144. The MP launched from the ship on 08 December 2008 at 11:11:32 after more than 12 hours of crew rest as "Shooter 253" to complete his CQ training. [encls 10,18,20,36]

145. The fuel quantity in the MAC at the time the MP commenced the flight was 9,696 pounds of fuel, which included 544 pounds in each wing tank, 2,080 pounds in Tank 1; 1,696 pounds in Tank 2; 1,344 pounds in Tank 3; and 3,488 pounds in Tank 4. [encl 36]

146. The MAC's gross weight at the time of take off was approximately 36,000 pounds. [encl 36]

147. The maximum arrested landing weight for F/A-18 aircraft is 33,000 pounds. [encl 38]

148. At take off, the MAC was above the maximum arrested landing weight. [encls 18,38]

149. Because the MAC would not dump fuel normally, the MP had to burn fuel to reduce gross weight below the maximum arrested landing weight. [encls 18,38]

150. The MP departed the landing pattern after the catapult takeoff, and flew a ten mile arc from the ship to burn the necessary amount of fuel. [encl 18]

151. When the MP determined he was close to maximum arrested landing weight, he entered the overhead "break" to establish his interval in the carrier landing pattern. [encl 18]

152. When the MP entered the landing pattern, he received an "oil pressure low" caution for the right engine (R OIL PR). [encls 18,36]

153. The MP reduced power on the affected engine in accordance with (IAW) NATOPS, communicated the problem to the ship, asked to speak to a squadron representative, and turned downwind. [encls 19,61,63,66,67]

154. At 11:20:59 the MP reported to MS TR that his right oil pressure gauge indicated 35 psi with the throttle at idle power. [encls 18,62,66]

155. MS TR instructed the MP to start his approach turn, but do not descend. [encl 66]

156. At 11:21:52, the MP stated his right oil pressure indicated 20 psi, and had slowly dropped to 15 psi at 11:23:58. [encl 66]

157. MS TR initially told the MP to keep the affected engine at idle power while flying the pattern, and when turning final to match up the throttles and fly a normal approach to an arrested landing. [encls 18,61,63,66]

158. The Air Boss almost immediately over-rode the command for the MP to plan on an arrested landing recovery aboard the ship and told MS TR "Stand by, disregard that". [encls 18,61,63]

159. The Air Boss and Ship's Captain conferred, and within approximately five minutes decided to divert the MP to shore. [encls 63,64,68]

160. At 11:24:59, RAG CAG asked the MP if he was "pointing towards North Island yet?" [encl 66]

161. At 11:25 the RAG CAG directed the MP to get his left engine at military power and start climbing, leave his gear down, and

stand by for the MS TR, and that he (MS TR) would probably recommend shutting the right engine down. [encls 18,61,62,66]

162. Low oil pressure indications in the F/A-18 aircraft can sometimes be system indicator or transmitter problems and not actual low oil indications. [encl 61]

163. Due to the cockpit indications of steadily decreasing oil pressure, MS TR believed the R OIL PR caution was an actual oil pressure problem that warranted a precautionary shutdown. [encl 61]

164. Normal procedure is for the carrier to operate within range of a suitable divert field while conducting initial CQ training for RPs. [encl 17]

165. Normal procedure is for an emergency aircraft to be sent to a shore-based divert field if there is one within range of the ship. [encl 17]

166. The Det OIC made a call to the MS at Miramar to alert them that MP was diverting single engine due to the R OIL PR caution, and that they suggested to the MP that he return to Miramar. [encl 58]

(3) Divert

167. At 11:25:19, 89 NM from NASNI and 100 NM from Miramar, the MS TR instructed the MP to "point towards (sic) North Island," accelerate to 200 knots (KTS), and start climbing out at 200 knots. [encl 18,61,66]

168. At 11:25:27, the MP passed his fuel state as 5,900 pounds [encl 66]

169. After the MP was told to "point toward" NASNI, MS TR passed MP the airspeed and altitude for a "BINGO profile" to NASNI. [encls 61,66]

170. The BINGO profile called for a cruise altitude of 13,000 feet above mean sea level (MSL) and a calibrated airspeed (CAS) of 197 KTS. [encl 67]

171. The BINGO profiles are designed as maximum range climb/ cruise/descent profiles for various aircraft configurations and weight. [encl 67]

172. The BINGO profile data, dated 16 November 1989, is based on the following parameters:

a. Initial altitude of sea level;

b. Military thrust climb to indicated altitude;

c. 250 knot calibrated airspeed (KCAS) idle thrust descent to sea level (speedbrake retracted);

d. Fuel reserve includes 1,500 pound reserve fuel; and

e. No wind.

[encl 67]

173. BINGO profiles are listed in increments of 20 NM, (e.g. 20, 40, 60, 80, etc.) [encl 67]

174. When the MP diverted, Miramar was within the same BINGO fuel range as NASNI (80 - 100 NM). [encl 67]

175. The single-engine, gear down, BINGO fuel quantity for a distance between 81 and 100 NM is 4,100 pounds of fuel. [encl 67]

176. Although he was approximately 1,800 pounds above the BINGO fuel quantity, the MP was instructed to fly a gear down single engine bingo profile to NASNI to conserve fuel. [encls 61,67]

177. An F/A-18 aircraft is "minimum fuel" when the expected fuel remaining upon landing will be less than 2,000 pounds. [encl 69]

178. An aircraft shall declare "emergency fuel" when the expected fuel remaining upon landing will be less than 1,500 pounds. [encl 70]

(4) R OIL PR Caution, Right Engine Shutdown

179. At 11:27:51, the Det OIC informed the MP "We got you going to North Island. If you assess that you can make it to Miramar

with a safe amount of fuel. Look at the Bingo numbers. It looks like that's the case, but if you can assess that you can. If you can get in there safely, then I want you to go to Miramar, if you can, OK? Plan on ...Base will be expecting you. We'll swap a jet out and you can come right back out and complete. OK?" [encl 66]

180. The MP acknowledged the transmission. [encl 66]

181. At 11:28:33, 89 NM from NASNI, below 5,000 feet and climbing, the MP performed a precautionary shutdown of the right engine due to the R OIL PR caution IAW NATOPS. The right oil pressure was reading 15 psi prior to shutting down the right engine. [encls 18,36]

182. At 11:28:30, the MP discussed with MS TR the BINGO profile descent point of 7 NM, and was told to "plan on making a normal recovery…we don't need to do anything strangely out of the ordinary." [encl 66]

183. The L/R OIL PR caution emergency procedure directs the pilot to shut down the affected engine if the caution remains after ten seconds of placing the throttle to idle. [encl 67]

184. The L/R OIL PR caution emergency procedure then states that if the caution clears when placing the throttle to idle, the pilot is to land as soon as practical. The procedure never dictates if the pilot is to land as soon as practical after shutting down the affected engine for an L/R OIL PR caution. [encl 67]

185. MS Standard Operating Procedures (SOP) states "If a land as soon as practical emergency situation exists, the landing should be made at the nearest suitable military or civilian airfield which has at least 8,000 feet of runway and the required support necessary to handle the emergency (i.e. arresting gear, instrument approach). [encl 71]

186. OPNAVINST 3710.7T guidance for twin-engine aircraft states "in the event of power failure or whenever an engine is stopped as a precaution on an aircraft that has two engines, the pilot in command shall land at the nearest suitable airport, in terms of time, provided weather conditions, terrain, and facilities available indicate that a safe landing can be accomplished." [encl 72]

187. "Land as soon as practical" is defined as "extended flight is not recommended. The landing site and duration of flight is (sic) at the discretion of the pilot in command." [encls 38,72]

188. MS TR never reminded the MP he was in a "land as soon as practical" situation or that he was to "land at the nearest suitable airport." [encls 18,61,66]

189. MS TR directed the MP to declare an emergency, told him he shouldn't be emergency fuel, and to drop his hook and plan on an arrested landing. [encls 18,61,66]

190. MS TR told the MP to "break out the single engine landing procedures." [encls 18,61,66]

191. Step three of the L/R OIL PR caution procedure is "refer to single engine approach and landing procedure." [encl 67]

192. MS TR instructed the MP to "let me know when you're up E34," indicating to the MP to get out his PCL and follow along on the steps on page E34 for the single engine approach and landing procedure. [encls 61,66]

193. The MP replied "go ahead" but did not pull out and reference his PCL at any time during the flight. [encls 18,66]

194. MS TR reviewed the single engine approach and landing checklist with the MP and recited steps one through six. MS TR stated "At this time we'll expect not to cross-bleed. We're gonna plan on taking an arrested landing. Just plan on keeping that motor shutdown and not turning... Ask SOCAL for a 7, 8, 10 mile straight-in." [encls 66,67]

195. Step two of the single engine approach and landing emergency procedure reads "when practical, maintain operating engine rpm [revolutions per minute] at or above 85% rpm to avoid MECH reversion." [encl 67]

196. "MECH ON" (MECH reversion) operation is a degraded flight control system status whereby the aircraft's horizontal stabilators (horizontal flight control surfaces on the tail of the aircraft) are not being electrically controlled through the flight control computer, and are only signaled by a direct mechanical link through the aircraft control stick. [encl 38]

197. The single engine approach and landing procedure, second note, reads "Hydraulic system capacity is dependent on respective engine rpm. Excessive simultaneous hydraulic system demands (i.e. landing gear activation, flap movement, and multiple flight control inputs, etc.) combined with single engine rpm below 85% may exceed hydraulic system capacity or result in FCS [Flight Control System] reversion to MECH. Therefore, when practical, maintain engine with operating HYD [hydraulic] system at or above 85% rpm." [encl 38]

198. NATOPS contains a "warning" that "reversion to MECH ON has often resulted in large pitch-up or pitch-down transients. [encl 38]

199. A "warning" is defined as "an operating procedure, practice, or condition, etc., that may result in injury or death, if not carefully observed or followed." [encl 38]

200. Interviews with several instructor pilots, including the RAG CAG, indicate that the practice of keeping the operating throttle above 85% while conducting single engine operation is emphasized during training, and students can receive a "downing grade" for failure to do so while conducting simulator training events. [encl 62]

201. MS CSIs teach single engine operation considerations within the context of the overall procedure; the NATOPS use of "when practical" does not prohibit the pilot from reducing the operating engine below 85% rpm if necessary. [encl 45,46]

202. The MS TR did not discuss the cautions concerning crossbleeding the inoperative engine listed under step 3. [encls 18,61,66,67]

203. A "caution" means "an operating procedure, practice, or condition, etc., that may result in damage to equipment, if not carefully observed or followed." [encl 38]

204. The second "caution" bullet in the single engine approach and landing procedure reads "[e]xtended crossbleeding of the failed engine traps feed tank fuel on that side if the FIRE light has not been pushed and may result in a flameout" [encl 67]

205. The MS TR did not discuss with MP the caution regarding extended crossbleeding of a failed engine to include pressing the FIRE light on the engine being crossbled "since I did not expect he would need to crossbleed the engine as his gear was already down." [encls 61,66]

206. The MS TR asked the MP to check the flight control system page on the right digital display indicator (DDI) to ensure his flight controls were not degraded. [encls 18,61]

(5) FUEL LO Caution

207. At 11:36:26, approximately 61 NM from NASNI and 72 NM from Miramar, the MP got a FUEL LO caution. [encls 36,73]

208. A FUEL LO caution indicates an engine feed tank contains 800 pounds, plus or minus 100 pounds, of fuel. It is presented to the pilot with a "fuel low, fuel low" aural cue, a FUEL LO annunciator light, and FUEL LO displayed on the left DDI. [encls 38,67]

209. After getting the FUEL LO caution, the MP reviewed his fuel tank quantities, and noted 770 pounds of fuel in the tank 2. [encl 18]

210. At the time of the initial FUEL LO caution the fuel quantities were:

Wing Tanks are empty and remain so the rest of the flight.
Tank 1: 512 pounds
Tank 2: 768 pounds
Tank 3: 864 pounds
Tank 4: 2144 pounds
Total: 4288 pounds
[encl 36]

211. During normal fuel transfer, Tanks 1 and 4 transfer their fuel completely to Tanks 2 and 3 before Tanks 2 and 3 begin to decrease in fuel quantity. [encl 38]

212. The MP did not perform each step in the emergency checklist for the FUEL LO caution in its entirety, to include all warnings, cautions, and notes. [encl 14]

213. Step two in the FUEL LO caution procedure reads "land as soon as possible." [encl 67]

214. "Land as soon as possible" is defined as "land at the first site which a safe landing can be made." [encls 38,72]

215. The following seven emergencies require the pilot to land as soon as possible:

1. Dual or single Bleed warning light(s)
2. Engine FIRE warning light
3. Avionics air hot (AV AIR HOT) caution
4. Left or right BLEED OFF caution
5. Dump Open (fuel dump valve open) caution
6. FUEL LO caution
7. Loss of Cabin Pressurization if decompression sickness (DCS) symptoms present

[encl 38]

216. Step three in the FUEL LO caution procedure reads "check for fuel transfer failure indications." [encl 67]

217. Step two in the fuel transfer failure (FUEL XFER) caution, which illuminates with "Tanks 1 and 4 fuel distribution out of balance" directs the aircrew to "Check transfer tanks 1 and 4." [encl 67]

218. There is no step in the FUEL LO caution procedure that directs the aircrew to "check" or "monitor" feed tank fuel quantity(ies). [encl 67]

219. Step one in a flight control system (FCS) caution is "MENU FCS-IDENTIFY FAILURE," which specifies selecting display menus to view system information. [encl 67]

220. The MP states he identified the FUEL LO caution and transmitted it to MS TR. [encl 18]

221. The ship's archived radio transmissions do not reflect the MP communicating the FUEL LO caution to the ship. [encl 66]

222. MS TR does not recall hearing the MP communicate the FUEL LO caution to him. [encl 61]

223. MS TR asked the MP "how far are you from Miramar or North Island at this point?" [encl 66]

224. Shortly after, there are two unreadable radio transmissions. [encl 66]

225. MS TR directed the MP to contact MS on the published base radio frequency ("base"). [encls 61,66]

226. After losing radio communication with the ship, the MP contacted "Beaver Control," the military airspace control agency for the military training airspace off the Southern California coast, and declared an emergency. [encl 18]

227. Beaver Control assigned the MP a heading of 010 degrees for NASNI. [encl 18]

228. Beaver Control assigned MP a radio callsign of "Shooter 25" [encl 18]

(6) Check in with MS Base (Base)

229. Approximately 50 NM from NASNI the MP contacted the MS at Miramar on "base," the base radio located in the MS ready room. [encl 18]

230. The MS operations duty officer (ODO) was (b) (6), (b) (7)(C) (b) (6), (b) (7)(C), who was also the MS NATOPS officer. [encls 53,58,74]

231. The MP informed the MS ODO that he had performed a precautionary shut down of his right engine for a R OIL PR caution, had a FUEL LO caution, and had 770 pounds of fuel in Tank 2. [encls 18,74,75]

232. The MP stated to base that the fuel quantities "continued to decrease and sequence normally." [encl 18]

233. For airborne emergencies the ODO is required to "ensure accurate communication of:

(1) Exact emergency or caution observed
(2) Location, fuel state, and time
(3) Provide guidance or direct assistance as applicable
(4) Task SDO to take notes and retrieve CO/XO/OPSO (etc.) as needed
(5) Expedite LSO to runway if needed

(6) Assign senior instructor to help as needed (e.g. Reading NATOPS, verifying/gathering information, etc.)

[encl 71]

234. The MS ODO did not read the entire emergency checklist for a FUEL LO caution to the MP, to include all warnings, cautions, and notes. [encl 75]

235. The MS Operations Officer (MS OPSO), having received a call from the ship, came into the ready room and took over the radio from the MS ODO. The MS ODO went to notify the MS Commanding Officer (MS CO) of the MP's emergency divert to Miramar, and dispatched a qualified Landing Signal Officer (LSO), (b) (6), (b) (7)(C) (b) (6), (b) (7)(C) to assist the emergency aircraft in landing at Miramar. [encls 53,54,58,74,114]

236. Upon MS ODO's return to the ready room, he did not mention the FUEL LO caution information to the MS OPSO or MS CO. The FUEL LO caution was never recorded on the MS ready room emergency board. [encls 58,74,78,114]

237. The MS CO was not initially made aware of the MP's FUEL LO caution, but was told all checklists were complete. [encls 53, 58,74,75]

238. The MS ODO was tasked with reviewing the NATOPS flight manual. [encls 58,74]

239. (b) (6), (b) (7)(C), a MS Instructor Weapons Systems Officer, was reviewing the NATOPS PCL as the MF progressed. [encls 58,74,76]

240. No one in the ready room was assigned to plot the relative bearing and distance from Miramar of the emergency aircraft. [encls 75,77,78]

241. The MS emergency board had one entry for the MAC distance from Miramar that read "37 NKX," indicating the MAC was 37 NM from Miramar and a second entry under location that read "9NM 3.0 @ 1151," indicating the MAC was 9 NM from Miramar with a total reported fuel quantity of 3,000 pounds of fuel at 11:51 local time. [encl 78]

242. MP had his TACAN tuned to Miramar and his inertial navigation system (INS) programmed for NASNI. [encl 14]

243. Although the MP reviewed with "base" the configuration and condition of his aircraft and confirmed with the OPSO what systems would be operational when landing single engine, no one in the ready room read to the MP the entire checklist for the single engine approach and landing to include all warnings, cautions, and notes. [encls 14,18,53,58,74,75,76,77,79]

244. The MS OPSO and the MP discussed keeping the throttle on the operating engine above 85%. [encls 18,58]

245. The MS OPSO initially informed the MP to plan a short field arrested landing on runway 24 at Miramar. [encls 18,58]

246. The MP asked and received confirmation from the MS OPSO that his destination was now Miramar. The MS OPSO received a head nod of concurrence from the MS CO. [encls 18,58,74]

(7) L AMAD Caution

247. At 11:41:38, approximately 41 NM south of NASNI and 52 NM south of Miramar, the MP got a L AMAD caution. [encl 36]

248. At the time of the AMAD caution the fuel quantities were:

Tank 1: 448 pounds
Tank 2: 672 pounds
Tank 3: 768 pounds
Tank 4: 2144 pounds
Total: 4096 pounds
[encl 36]

249. The FUEL LO caution was still displayed in the cockpit. [encl 36]

250. The MP notified MS of the L AMAD caution. [encls 18,53,58,74]

251. A L/R AMAD caution will be displayed when "[d]esignated AMAD oil temperature [is] high." [encl 67]

252. Step one in the emergency procedure for L/R AMAD caution inflight is "Throttle affected engine-IDLE." [encl 67]

253. NATOPS states that a L/R AMAD caution "[m]ay be caused by an over-serviced AMAD, AMAD heat exchange failure, hot fuel recirculation system failure, or motive flow system failure." [encl 67]

254. The third remark under a L/R AMAD caution reads "[a]n empty feed tank or BOOST LO caution will cause loss of AMAD cooling." [encl 67]

255. There is no discussion in the cause/remarks section, nor any procedural step under the L/R AMAD caution that directs the aircrew to check the feed tank fuel quantities. [encl 67]

256. The "warning" in the L/R AMAD caution procedure reads "Prolonged operation of a hot AMAD may result in an engine/AMAD bay fire." [encl 67]

257. The MP did not read or conduct the procedure steps for the L AMAD caution. [encl 14]

258. The MS OPSO acknowledged the report of the L AMAD caution, but did not read the emergency procedure to the MP including all warnings, cautions and notes. [encls 14,79]

259. The MP switched his primary radio from Beaver Control to the FAA's SOCAL Approach (SOCAL) approximately 20 NM from NASNI. [encls 18,56]

260. The MP told SOCAL, "I've got a single engine, dirty, possibly a problem with the other engine and time in fuel remaining about 20 to 30 minutes." [encl 56]

261. SOCAL gave the MP the Airport Terminal Information System (ATIS) for NASNI and asked MP if he wanted the visual straight-in approach to RWY 36 at NASNI. [encl 56]

262. The MP informed SOCAL of his intent to proceed to Miramar.[encl 56]

263. SOCAL Approach gave the MP a vector of 010 for either NASNI or Miramar. [encl 56]

264. SOCAL Approach asked the MP if he wanted to remain at his present altitude (13,000') or descend; the MP told SOCAL Approach to stand by. [encl 56]

265. SOCAL Approach asked the MP if he wanted the visual straight-in approach to Miramar and the MP answered affirmatively. [encl 56]

266. SOCAL Approach asked the MP if he wanted to a lower altitude and MP said "no, not at this time." [encl 56]

267. SOCAL Approach told MP, "just let me know if you want to change course, I'm going to keep you on that heading (010). It's going to run you right by North Island (NASNI) and it's going to be the shortcut to Miramar, so just let me know what you need" and the MP answered "Roger." [encl 56]

268. MS OPSO told the MP to plan on a straight-in approach to runway 6 left (RWY 06L) to expedite his landing, and the MP confirmed it would be an arrested landing. [encls 18,58]

269. MP told SOCAL Approach that "this is going to be a straight in approach to RWY 06L at Miramar." [encl 56]

(8) L BOOST LO caution

270. At 11:47:33, 18 NM south of NASNI and 29 NM south of Miramar, the MP got a L BOOST LO caution that cycled four times then remained on. [encls 18,56]

271. At the time of the initial L BOOST LO caution the fuel quantities were:

Tank 1: 256 pounds
Tank 2: 416 pounds
Tank 3: 544 pounds
Tank 4: 2144 pounds
Total: 3328 pounds
[encl 36]

272. The FUEL LO caution was still displayed. [encl 36]

273. A L/R BOOST LO caution is caused by "loss of fuel boost pressure" to the engine. [encl 67]

274. The third step in the L/R BOOST LO emergency procedure reads "[m]onitor fuel transfer." [encl 67]

275. The third note under "Cause/Remarks" reads "[m]ay indicate fuel transfer failure." [encl 67]

276. The L/R BOOST LO procedure does not contain any instructions that direct the aircrew to check the feed tank fuel quantities. [encl 67]

277. The MP communicated the L BOOST LO caution to the MS OPSO, who acknowledged the L BOOST LO caution but did not read the emergency procedure to the MP to include all warnings, cautions and notes. [encls 14,18,53,58,74,75,77,79]

278. The MP asked the MS OPSO to confirm that his descent point was 7 miles from Miramar. When confirmed, the MP asked if it was an idle descent but was told to keep the throttle at 85% in the descent. [encls 18,58]

(9) Right Engine Crossbleed

279. MS directed the MP to "crank the right engine" (crossbleed using pneumatic pressure from the operating engine). This was acknowledged by the MP a few minutes later. [encls 18,58,74]

280. The MS did not direct the MP to re-start the right engine. [encls 18,53,58,74]

281. Major A. A. Dixon, the MS Department of Safety and Standardization (MS DOSS) head, was in the fuel pits monitoring base radio. [encl 80]

282. MS DOSS transmitted over base to start the right engine for landing which the MS ODO heard but the MP did not. [encls 18,74,76,80,81,82]

283. The MP started cranking the right engine at 11:51:15. [encl 36]

284. Upon cranking the right engine the fuel quantities were:

Tank 1: 192 pounds
Tank 2: 352 pounds
Tank 3: 512 pounds
Tank 4: 2016 pounds
Total: 3072 pounds
[encl 36]

285. The MP expressed concern about executing an idle descent. [encls 18,58]

286. Flown in the simulator by the investigation team, a single engine BINGO profile descent flown with the operating engine at 85% rpm and a seven mile descent point resulted in descent rates in excess of 15,000 feet per minute (normal approach and landing descent rates are between 700 and 1,000 feet per minute) and the aircraft crossed the landing threshold at 330 KTS. Normal approach speed for the MAC's configuration and weight is approximately 142 KTS. [encls 67,83]

287. SOCAL Approach prompted the MP to descend on six separate occasions. [encl 56]

288. After the MP began his descent, SOCAL Approach made several attempts to give MP a right turn direct to Miramar. [encl 56]

289. The MP notified SOCAL Approach that he was in a left turn, and continued to execute a left 270 degree turn to descend and align with the runway. [encl 56]

290. Step five of the single engine approach and landing procedure reads "Plan approach to make turns using shallow bank angle (20°)." No distinction is made in this step regarding required or prohibited direction of turn (i.e. into or away from the failed or operating engine) [encl 67]

291. The MP broke out of the clouds at approximately 2,500 feet over the water and west of the airport. It took the MP a few moments to get oriented and pick out the runway. [encls 18,84]

292. The MP had never flown a straight in landing to RWY 06L. [encl 14]

293. SOCAL Approach cleared the MP for the visual straight in approach to RWY 06L and instructed him to switch to Miramar tower frequency. [encls 18,56]

(10) Ejection

294. At 11:57:04, when the MP broke out of the clouds, the fuel quantities were:

Tank 1: 128 pounds
Tank 2: 128 pounds
Tank 3: 1152 pounds
Tank 4: 1312 pounds
Total: 2816 pounds
[encl 36]

295. The MP switched his auxiliary radio to the LSO and turned down the volume on his primary radio which was still tuned to SOCAL. [encl 18]

296. Miramar Tower, on the LSO radio frequency, cleared the MP for an arrested landing on RWY 06L. [encls 18,85]

297. The MP retarded the throttle on the left engine to slow to landing speed and felt the engine spool down. The MP pushed the left throttle back up but felt no response. He then saw the engine rpm dropping below 63%. [encl 18]

298. The MP advanced the right and left throttles to maximum thrust. [encls 18,36]

299. The right engine began to restart, but was not yet producing useable thrust. [encl 36]

300. At 11:57:42, the left engine flamed out. Tank 2 contained 96 pounds of fuel. [encl 36]

301. At left engine flameout, the MP had been cranking the right engine for six minutes and 28 seconds. [encl 36]

302. The MS LSO gave the MP instructions for the arrested landing and subsequently noticed a puff of smoke from the MAC as the MP transmitted "I just lost my motor." [encls 59,85]

303. The MP looked down and saw houses beneath him and a canyon to the left. He turned the MAC to the left to attempt to reach the canyon. [encl 18]

304. The MAC changed heading 30 degrees to the left and the MP did not attempt any further maneuvering. [encl 36]

305. The MP felt the nose of the MAC get heavy, lost all electrical power in the cockpit, and ejected. [encl 18]

306. The LSO saw the aircraft turn left and the nose pitch down, and transmitted "eject, eject, eject." [encls 59,85]

307. 17 seconds elapsed from the time the MP transmitted "I just lost my motor" to initiation of the ejection. [encls 36,85]

308. The MS DOSS transmitted "good chute" on base indicating he had observed a successful deployment of the parachute following the ejection. [encls 53,58,59,80]

309. The MS initiated the mishap plan. [encls 53,58]

310. The MP successfully ejected from the MAC at 11:57:59, approximately 400 feet above the ground. [encls 18,54,80,85,86]

G. POST MISHAP

311. Just prior to impacting the ground, the MAC clipped a tree on the east side of 4419 Cather Avenue. [encls 87,88]

312. The landing gear left skid marks between 4411 and 4416 Cather Avenue, and the left wingtip sliced a line two feet long into the pavement. [encl 89]

313. The fuselage impacted the pavement and sidewalk curb along the landing gear skid marks. [encl 90]

314. The wreckage proceeded across the driveway of 4416 Cather Avenue and impacted a storage trailer that was parked on the driveway. [encl 91]

315. The right wing impacted the northwest corner of the garage and main structure of 4416 Cather Avenue. [encl 92]

316. There were four civilians in 4416 Cather Avenue who suffered fatal injuries as a result of the mishap: (b) (6), (b) (7)(C), a 59 year old female; (b) (6), (b) (7)(C), a 36 year old female; (b) (6), (b) (6), a 15 month old female; and (b) (6), (b) (7)(C), a one-month old female. [encl 93]

317. There was total loss of structure and contents at 4416 Cather Avenue. [encls 92,94]

318. The majority of the impact was into the house at 4406 Cather Avenue. [encls 94,95,96]

319. There was total loss of structure and contents at 4406 Cather Avenue. [encls 95,96]

320. 4406 Cather Avenue was not occupied at time of impact. [encl 94]

321. The fuselage remained in the structure of 4406 Cather Avenue, approximately 120 feet from initial impact. [encls 95,96,97,98]

322. The left and right wings came to rest upon the dirt berm along the south side of Huggins Street, approximately 150 feet from initial impact. [encls 96,97,98]

323. The wing leading edge extensions, nose, left/right engines, and horizontal stabilators proceeded beyond the berm and came to rest in the middle of Huggins Street between 4370 and 4371 Huggins Street, approximately 200 feet from initial impact. [encls 96,97,98]

324. The tip of the right horizontal stabilator came to rest on a vehicle parked on the south side of Huggins Street, between 4380 and 4381 Huggins Street. [encls 96,97,98]

325. The left AMAD was found in the backyard on the cement patio of 4370 Huggins Street. [encls 96,97,98]

326. The aft cockpit ejection seat separated from the fuselage at impact and landed beyond the impact site, in the canyon at latitude N 32.8614, longitude W 117.1971. [encls 98,99]

327. The nose radome section and other burning debris were lodged under a pickup truck parked near 4380 Huggins Street; the truck was destroyed by fire. [encls 96,98,100]

328. The house at 4371 Huggins Street received smoke and heat damage along its west walls. [encls 96,98,100]

329. Two vehicles in the driveway of 4371 Huggins Street were destroyed by fire. [encls 96,100,101]

330. The north-walled patio at 4426 Cather Avenue was destroyed by fire. [encls 96,98]

331. One vehicle in the driveway of 4370 Huggins Street was destroyed by fire. [encls 96,98,102,103]

332. The majority of the canopy landed in the front yard of 6565 Red Deer Street. [encls 94,97,99]

333. A small piece of the canopy landed on the property of 6550 Red Deer Street. [encls 94,97,99]

334. Miscellaneous debris landed at 4054 Calgary Avenue. [encl 99]

335. Miscellaneous debris landed at 4018 Calgary Avenue. [encl 99]

336. Miscellaneous debris landed at 4042 Calgary Avenue. [encls 94,99]

337. The parachute, seat pan, and MP landed at 4311 Robbins Street. [encls 94,97,99]

338. The front cockpit ejection seat landed at 4250 Robbins Street. [encls 94,97,99]

339. The wreckage pattern was approximately 200 feet in length and 60 feet in width. [encls 96,98]

340. San Diego Fire Department (SDFD) was the first emergency response unit to arrive at the mishap site with a rescue vehicle (San Diego truck #35) at 12:09 and established an incident command center on Huggins Street. [encls 96,100,101]

341. MCAS Miramar Fire Department Engines 60 and 62 (MFD 60 and 62) arrived behind truck #35 at 12:09, parked by the SDFD fire truck and, as the first firefighting capable vehicles on scene, assisted in the firefighting effort. [encls 96,100,101]

342. MCAS Miramar Aircraft Rescue Fire Fighters (ARFF) responded with three P-19 military fire trucks and parked on Huggins Street. ARFF began to identify and communicate F/A-18 specific hazards, account for any explosives, verify the number of aircrew, and determine ejection seat status. [encls 96,104]

343. ARFF verified with the MS that the MAC had no ordnance on board and notified the Fire Department. [encls 94,103]

344. ARFF notified the Fire Department of the potentially toxic fumes from the burning composite materials. [encls 94,103]

345. ARFF remained overnight to assist in hazardous material control. [encl 104]

346. On 09 December 2008 ARFF began to spray wax sealant on the wreckage pieces to contain any carbon fibers; they completed this task on 10 December 2008. [encl 104]

347. Miramar Ambulance 2 parked east of the firefighting vehicles and provided medical attention to an unidentified woman and child. After transferring the woman and child to a SDFD ambulance, they proceeded to the MP location at 4307 Robbins Street. [encl 106]

348. An SDFD ambulance assessed the MP for injuries and transported him to Navy Regional Medical Center San Diego. The MP was sustained minor bruises and scrapes. His toxicology report indicated zero blood alcohol content and no illegal drugs. [encls 8]

349. MCAS Miramar duty Fire Chief (MFC), arrived on scene and assisted with establishing a Unified Command Center with SDFD on Cather Avenue southwest of the mishap site. [encl 88]

350. MCAS Provost Marshal Office police (PMO) parked behind the SDFD vehicles on Cather Avenue and established a perimeter around the mishap site with San Diego Police Department personnel. [encls 94,104]

351. SDFD was fighting the fire at 4406 and 4416 Cather Avenue. [encl 101,106]

352. MFD 60 and 62 extinguished a vehicle fire at 4371 Huggins Street and subsequently began protecting the house at 4371 Huggins Street from the fires at 4406 and 4416 Cather Avenue. [encl 101]

353. Four fire fighters from MFD 60/62 checked for survivors and evacuees along Huggins Street. There were visible indications on the houses that SDFD had recently performed the same task. [encl 101]

354. Smoke blowing from west to east impaired visibility at the mishap site. [encl 101]

355. There was initial difficulty accounting for residents of the damaged homes. [encl 88]

356. Several hours after the mishap, neighbors reported that there might be occupants in 4416 Cather Avenue. [encl 101]

357. MFD 60 and 62 were relieved approximately four hours after the mishap. At this point three bodies had been recovered. [encl 101]

358. ARFF does not possess 800 megahertz radios to communicate with the civilian firefighters, but MFD does and routinely uses them in San Diego County emergency responses. [encls 88,104]

359. All post-mishap fires were extinguished on 08 December 2008. [encls 94,106]

360. MCAS Miramar Environmental Office contracted an environmental assessment and cleanup. The initial site assessment commenced on 09 December 2008. [encl 107]

361. The AMB released the wreckage site to MCAS Miramar Environmental on 0800 12 December 2008 [encl 94,107]

362. Air monitoring at the mishap site was conducted until 14 December 2008. Results were typical of structural fire and no abnormal thresholds noted. [encl 107]

363. San Diego Police Department Command Post departed the site at 0900 12 December 2008. [encl 107]

364. Miramar PMO Command Post remained on site until 1200, 23 December 2008. [encl 107]

H. Miscellaneous

365. An American Airlines MD-82 had a loss of engine thrust on take off from San Diego Lindbergh International with 141 passengers and crew onboard and successfully diverted to RWY 06L at Miramar on June 25, 1999. [encl 108]

366. The simulators used by the MS to train RPs do not accurately replicate halting gravity fuel transfer between feed tanks when crossbleeding an inoperative engine. [encl 83]

367. The simulators used by the MS to train RPs did not visually display RWY 36 at NASNI until the end of November. To date, there is no ability to record approach parameters or simulate a field arrestment on RWY 36. [encl 83]

368. Marine Forces Pacific published a General Use Hazard Report concerning F/A-18 MSP codes or code groups indicating possible motive flow fuel transfer degradation on 12 January 2009. This was in response to post-mishap findings from the AMB. [encl 109]

369. The Commanding Officer of MAG-11(REIN) issued a directive on 22 January 2009 for all F/A-18 units to increase awareness of fuel-related MSP codes and initiate an interim trend analysis program to monitor their occurrence. It directs that an aircraft will be placed in a down status for three occurrences of a single fuel-related MSP code in the last ten flights, or a single MSP code occurrence in conjunction with any fuel-related discrepancy. [encl 110]

Opinions

A. The MP

1. The MP, a recently promoted active duty Marine Captain and student at VMFAT-101, met all ground and flight syllabus requirements, was medically and physiologically qualified, NATOPS current and qualified, aeronautically adapted, well-rested and physically and mentally prepared to conduct the mission. He lived locally and had no apparent personal problems that would affect his performance. [FOF 1-6,8-20,94-96]

2. The MP had finished above average in flight school and had been an overall above average performer in the FRS. He had received two signals of difficulty in the FRS (BFM stage) for descending below the minimum training altitude and exceeding the safety boundaries during high aspect passes. The MP was referred to a Human Factors Board (HFB) and an RP review board (RPRB). These deviations in performance were the exceptions to an otherwise above average history, and no unsafe trends or questionable judgment were noted. [FOF 7,21-31]

3. The MP was adequately trained, qualified, current, assigned and scheduled for the CQ mission. He was close to finishing the CQ syllabus and was performing above average for phase. [FOF 33-43,94-98,135,141-143]

4. The MP was aware the primary divert was NASNI for the 08 December 2008 CQ evolution. Although he had only flown into NASNI once in the training command, all of his simulator CQ emergency diverts were into NASNI. This should have made the MP comfortable with diverting to NASNI, even though the simulator visual does not support full RWY 36 approach parameters. [FOF 32,35,135, 143,366,367]

5. On the day of the mishap, the MP's conduct around the ship and during the initial phase of the divert was professional and in accordance with governing procedures and regulations. [FOF 144-163,167-169,176-189,227,228]

6. The MP should have landed at NASNI but allowed himself to be influenced by the CQ Det OIC and the MS TR to continue to Miramar. OPNAV 3710.7T states that a twin engine aircraft that has lost the operation of one engine will land at the nearest suitable divert. NASNI was closer to the ship, had almost the identical weather as Miramar, was briefed as the primary divert, and had three spare aircraft staged there over the weekend

specifically for the CQ det. By all reasonable parameters, NASNI was a suitable divert. Once the MP had secured the right engine the decision to land at NASNI should have been clear. The fact that his fuel state was well above BINGO should have been irrelevant to the divert airport analysis. Under different circumstances (e.g. poor weather at NASNI), Miramar could be a suitable option. However, in this case NASNI was the appropriate choice. Continuing to Miramar was a poor decision that was causal to the mishap. [FOF 116-134,136,137,143,166, 167-180,182,185-189,242,262]

7. The MP should have referenced his PCL for all of his inflight emergencies after the R OIL PR caution. RPs are taught to rely on the MS TR to read the PCL and emergency procedures to them when in the carrier landing pattern. When the MP left the low altitude environment of the carrier landing pattern and began the divert to shore he should have pulled out and read the PCL for all emergencies. The MP got a FUEL LO caution, had a patent fuel transfer issue, got a L AMAD caution and a L BOOST LO caution. He did not once reference the PCL for any of these issues nor perform the procedures contained therein. The FUEL LO caution should have indicated to the MP that he land "as soon as possible." In this case, "land as soon as possible" would have been at NASNI. [FOF 99,181-183,190-197,207-218,247-257,270-278]

8. Had the MS TR heard the MP transmit his FUEL LO caution, he likely would have directed the MP to divert to NASNI. Step two in the FUEL LO procedure is to "land as soon as possible." The MP believes he communicated his FUEL LO caution to the MS TR but this transmission was never received. There are two unreadable radio transmissions at approximately the same time the FUEL LO caution appeared. The RAG CAG and MS Det OIC, who were both monitoring the radio, knew the exact relative position of the ship to Miramar and NASNI. Had they heard the FUEL LO caution, they also would likely have directed the MP to divert to NASNI and ruled out Miramar. [FOF 116-134, 220-226]

9. The MP demonstrated an unacceptable lack of assertiveness even given his lack of experience. Assertiveness is one of the seven aspects of Crew Resource Management (CRM). By neglecting to emphasize his FUEL LO caution and failing to question base's decision to send him to Miramar, the MP allowed himself to be put into an untenable position. Being subjected to an RPRB may have negatively affected his assertiveness. The fact that the

MP asked more than once to confirm that he was still to land at Miramar indicates that he had reason to question that decision. The MP's lack of assertiveness was a contributing factor to the mishap. [FOF 21-30,207-211,229-233,242,245,246]

10. The MP placed too much emphasis on maintaining 85% RPM on the left engine. Step two of the Single Engine Approach and Landing procedure reads "when practical, maintain operating engine rpm at or above 85% rpm to avoid MECH reversion." The phrase "when practical" allows aircrew flexibility in applying the procedure based on the totality of the circumstances presented. The MP misinterpreted this phrase as a mandate. This misinterpretation caused him to reject several recommendations to descend from the SOCAL approach controller which resulted in him being too high and too close to the airport when he commenced his descent. [FOF 97,98,195-203,206,244,266,267,278,285-287]

11. The MP placed too much emphasis on turning only into an operating engine. Step five of the Single Engine Approach and Landing procedure reads "planned approach to make turns using shallow bank angle (20 degrees)." The MP misinterpreted this phrase as requiring turns only into an operating engine. This misinterpretation caused him to reject several recommendations from the SOCAL approach controller to turn right. The left turn used critical fuel that contributed to the mishap. [FOF 182,288-290]

12. The MP did not fully understand the implications of cranking (crossbleeding) the right engine. The caution in the Single Engine Approach and Landing procedure reads "extended crossbleeding of a failed engine traps feed tank fuel on that side if the FIRE light has not been pushed, and may result in a flameout." The six minutes that elapsed from cranking the right engine to left engine flameout would have been obviated had the MP started the right engine or not cranked it to begin with. The decision to crank but not start the right engine contributed to the mishap. [FOF 193,279-284,301]

13. The MP did everything he could to avoid the residential area prior to ejecting. Seventeen seconds elapsed between the left engine flameout and the initiation of the ejection, during which time the MP attempted to steer the MAC left into the vacant canyon, until he ejected at 400 feet above the ground. [FOF 298-301,303-307, 310]

B. The MAC

14. Clearer, more definitive guidance in maintenance publications and more aggressive maintenance troubleshooting could have identified and corrected the MAC's internal wing fuel transfer problem prior to the mishap. MSP codes are diagnostic tools designed to assist in identifying particular system or component faults or failures. MSP codes related to the left motive flow boost system were persistent for several months, but there were no governing maintenance documents that specifically identified these codes as up or down discrepancies. The left wing slow to transfer MAF was written and put into work several months prior to the mishap, but was not corrected because of the lack of guidance on MSP code significance and the lack of definitive troubleshooting steps in the maintenance publications. The aircraft was flown safely 146 times over the next several months. Unfortunately, there was an actual degradation of left Motive Flow Boost system pressure that slowly worsened over time, the symptoms of which were masked to the aircrew by the built-in fuel system redundancies. With the right engine shut down, the redundancy was eliminated and the fuel transfer problem became paramount. Unrecognized by the MP and the ready room personnel, the fuel transfer problem contributed to the mishap. [FOF 50-53,59-80,100-115,368,369]

15. The MESM is not intended to be the sole source document for determining up or down status of an aircraft. The MESM lists systems that dictate an aircraft be categorized not-mission-capable for any system failures/discrepancies that negatively effect safety of flight, to include the fuel system. The MESM does not specify which MAFs or MSP codes define the aircraft as not safe for flight and practitioners state it is too "vague." The sentiment that the MESM is vague coupled with the history of the outstanding MAFs contributed to the decision to defer maintenance on the left internal wing transfer MAF. [FOF 81-83]

16. Other than the two outstanding MAFs, the ADB was unremarkable. [FOF 44-49,54-56]

17. The MAC right engine experienced an actual oil pressure loss on the MF. The right engine was shut down in accordance with NATOPS. Post-flight engineering investigations revealed an oil leak likely caused by a degraded seal. The precautionary shutdown of the right engine was in accordance with NATOPS.

However, with the multiple emergencies related to the left engine that occurred in the MF, the right engine could have been re-started prior to final approach, and would have produced useable thrust for an indeterminate amount of time. [FOF 54,55,154,156,157,162,163,179-181]

18. The MAC experienced a serious degradation of left motive flow boost pressure. The pressure degraded below the minimum 10 psi required for the Tank 2 Jet Level Sensor to operate. Post-flight engineering investigations concluded that the left AMAD, left motive flow boost pump, and all fuel tank transfer and boost pumps were operable prior to impact. This pressure degradation was likely caused by either a leak or a blockage of the left motive flow fuel lines. [FOF 50-53,57,76-78]

19. The left wing fuel transfer MAF was deferred for months with the aircraft remaining in a mission capable (or safely flyable) status due to lack of publication guidance requiring the aircraft be declared non-mission capable. Power Plants wrote a MAF to begin their portion of troubleshooting the left wing fuel transfer discrepancy, but was unable to identify the specific cause. Identifying the point of failure would have required replacing parts, and even then, the associated work package would not have led to resolution or a definitive non-mission capable determination. Maintenance Control wanted the aircraft on the flight schedule since it was determined to be mission capable. Had contract maintenance performed further troubleshooting as desired, it is reasonable to infer that the cause of the left motive flow boost pressure failure would not have been traced to component failure, since post-mishap analysis determined all related components were operable. Finding the source of the problem would have required further extensive troubleshooting and possibly outside assistance to correct the discrepancy. [FOF 51-53,57-83]

20. The initiation of the left wing transfer MAF occurred during a backlog of aircraft in phase maintenance, but this backlog was mostly resolved by the time the MAC entered its phase "A" inspection in August 2008. Although there is no requirement to correct all discrepancies during phase maintenance, this was another opportunity for the MS maintenance department to examine the left wing fuel transfer MAF history, including the existing MSP codes, and direct further corrective action. [FOF 47,57,62-83,86-93]

21. Ambiguities in existing maintenance publications allowed the MS maintenance department the discretion to keep the MAC in a flyable status; they did not violate any directives by keeping it in this status. Nevertheless, the authority to sign an aircraft "safe for flight" requires assessing the overall airworthiness of the aircraft, to include correlations between existing MAFs. The left wing transfer MAF and the fuel dump MAF were related and caused by a degraded left motive flow boost pressure; with better systems analysis this correlation could have been recognized by the safe for flight authority on the ship. [FOF 58,59,60-64,68,69,81-83,100-113]

C. The MS

22. The MS CO failed to properly supervise and direct the actions of the ready room during the inflight emergency and failed to ensure the use of sound Crew Resource Management (CRM). The squadron SOP outlines the procedures to be followed in the ready room, NATOPS defines emergency procedures, and OPNAV governs single engine divert requirements. Crew Resource Management is a mandatory annual qualification. Nobody identified the MAC's location as it related to Miramar and NASNI; if so they would have recognized that the MP would overfly NASNI. Nobody read the NATOPS procedures for the FUEL LO, L AMAD, or L BOOST LO cautions; if so they would have realized the requirement to "land as soon as possible." Nobody read the entire Single Engine Approach and Landing procedure; if so they would have recognized the caution regarding extended crossbleeding of the failed engine. The MS CO was in the ready room throughout this evolution yet failed to direct mission analysis that would have revealed the related nature of the multiple emergencies. The initial request by the MS CO to confirm that all checklists were complete does not mitigate his responsibility to maintain situational awareness throughout the emergency. The conduct of all ready room personnel during the mishap flight is a direct reflection on the MS CO and was a major contributing factor in the mishap. [FOF 100-115,143,229-295]

23. The MS CO demonstrated poor judgment during the inflight emergency. He was not aware that all arresting gear at NASNI was available and allowed a previous F/A-18 mishap at NASNI to cloud his judgment as to its suitability as a divert. Also, he overemphasized the importance of having an LSO available to assist the MP with an arrested landing. The MP's emergency did

not require a "fly-in" arrestment. The chain of command's desire to bring the MP to Miramar in order to get him back out to the ship ignored the fact that there were three CQ spare aircraft available at NASNI. Furthermore, when the MP asked for confirmation between Miramar and NASNI, it was the MS CO that ultimately directed Miramar as the divert. [FOF 116-134,246]

24. The MS OPSO failed to apply sound CRM. He failed to communicate effectively with the MP and did not realize the MP had a FUEL LO caution. As the emergencies compounded he failed to apply sound mission analysis or systems knowledge to identify that the emergencies were related. His situational awareness was degraded due to not knowing the position of the MP. Finally, he concurred with the faulty decision to continue the MF to Miramar. The MS OPSO's CRM failures and faulty systems knowledge were a contributing factor to the mishap. [FOF 233-295]

25. The MS ODO failed to apply sound CRM and follow squadron SOP. He failed to communicate all the information regarding the MP's emergency to the MS OPSO and MS CO, especially the crucial fact the MP had a FUEL LO caution. He failed to assert himself as a NATOPS instructor and correct the disregard for procedures and faulty system analysis during the emergency. He was responsible for plotting the MAC's position and other pertinent information on the ready room emergency board but did not do so. The MS ODO's CRM failures and SOP violations were contributing factors to the mishap. [FOF 229-236,240,241,243,244,247-252,255,258,270-280]

26. The MS AMO did not fail in his supervisory duties. Although he is the final signature approval authority for aircraft successfully completing phase maintenance, there is no directive that all outstanding MAFs be corrected during a phase inspection. The left wing fuel transfer MAF was put in work but not corrected, but the MS AMO did not violate any procedure by signing a Phase "A" inspection sheet that included "up" MAFs that were outstanding. [FOF 67-83,86-93]

27. The MS MMCO did not fail in his supervisory duties. Although his signature on the Phase "A" packet indicated to the AMO that the aircraft had successfully completed phase maintenance, and he recommended the aircraft be certified complete with phase there is no directive that all outstanding MAFs be corrected during a phase inspection. [FOF 67-83,86-93]

28. The MS Det OIC should have exercised better judgment. He failed to realize that the MP's single engine status required him to land at the nearest suitable airfield. OPNAV 3710.7T states that a twin engine aircraft that has lost the operation of one engine will land at the nearest suitable divert. He was aware that NASNI was closer to the ship, had almost the identical weather as Miramar, and was briefed as the primary divert. The suggestion that the MP continue to Miramar if fuel wasn't a factor went against OPNAV guidance. The MS Det OIC should not have suggested the MP swap jets to complete CQ that afternoon. This decision should have been made once the aircraft was safe on deck. Had the MS Det OIC exercised sound Operational Risk Management (ORM), he would have avoided suggesting the MP proceed to Miramar, which contributed to the mishap. [FOF 135,136,166,179]

29. The MS TR should have read the entire Single Engine Approach and Landing procedure to the MP, including all warnings, cautions, and notes. The procedure states that extended crossbleeding of a failed engine traps feed tank fuel on that side if the fire light has not been pushed and may result in a flameout. When the MP departed the ship's landing pattern, the MS TR correctly implied that the MP should pull out his PCL by telling the MP to "let me know when you are up page E34." However, the MS TR's suggestion that cranking the right engine wouldn't be a factor was speculative and incorrect. Had the MS TR read the entire procedure concerning crossbleeding, the MP likely would have had better awareness of its effects when later instructed to crank the right engine. The MS TR's omission of the caution and his concurrence with the MS Det OIC's suggestion to proceed to Miramar contributed to the mishap. [FOF 153-157,161-167,182,188-194,202,205,206,222-225]

D. The Ship

30. The ship's Captain, Airboss, and the RAG CAG made a conservative and prudent decision to divert the MAC to shore with the R OIL PR caution. The fact the oil pressure was steadily dropping indicated a probable actual loss of pressure rather than an indicator or pressure transducer failure. Rather than risk catastrophic engine failure on carrier approach, they elected to divert the MAC to the published primary divert of NASNI. The Captain's authority in this regard is undisputed and the decision was a sound one. [FOF 138-140,158-161,173-175]

31. The RAG CAG's statement to the MP that he should keep his gear down and he really didn't have another option was incorrect. The MP had the option to raise his gear in order to minimize fuel consumption. The assumption at the time was that the MP had more than enough fuel to leave his gear down for the divert. It was logical to leave the gear down since the MP had not relayed any indications of an impending fuel emergency, and it also simplified the MP's concerns for landing. Although fuel later became causal to the mishap, this decision didn't violate procedures and was sound given the facts at the time. [FOF 160,161]

E. NAVAL AIR SYSTEMS COMMAND (NAVAIR)

32. There is no published guidance from NAVAIR on which MSP codes dictate a non-mission capable status for the F/A-18A-D aircraft. MSP codes identify system component failures in order to assist troubleshooting of aircraft discrepancies. Without this guidance, individual units are left to their own discretion in deciding a code's relative significance. The MS maintenance department lacked specific guidance to resolve this issue. With an approved criticality list or downing list of MSP codes, the MS likely would have downed the aircraft, preventing the mishap. The fact that a HAZREP listing specific MSP codes related to this mishap has since been published further suggests the need for a criticality list. [FOF 64-67,72-74,76,77]

33. The MSP code trend analysis programs in the F/A-18A-D community are insufficient. [FOF 65-67,73,74]

34. Work packages used to troubleshoot the left motive flow boost pressure MSP codes are inadequate. [FOF 69,70,72,73]

35. NATOPS single engine BINGO profiles conflict with the Single Engine Approach and Landing Procedure. BINGO profiles call for an idle descent, while the Single Engine Approach and Landing procedure directs the pilot to maintain 85% rpm on the operating engine when practical. The BINGO profiles were not updated after the changes to the Single Engine Approach and Landing procedure incorporated the 85% rpm guidance. These conflicting procedures are not well understood within the F/A-18 community and confused the MP, contributing to the mishap. [FOF 171,172,195-201,244,278,285,286]

36. The F/A-18 NATOPS Single Engine Approach and Landing procedure conflicts with OPNAV 3710.7T. The NATOPS procedure does not direct the pilot to land as soon as practical, or to land as soon as possible, but OPNAV 3710.7T directs the pilot in command to land at the nearest suitable airport when single engine. Under a reasonable interpretation of the OPNAV instruction, the MP would have landed at NASNI. [FOF 186-188]

F. Simulator programming

37. The F/A-18 simulator fails to duplicate the fuel system actions of closing the feed tank interconnect valve and stopping gravity feed during crossbleed operation. This lack of simulation of a key system function that is a caution in the Single Engine Approach and Landing procedure leads to an inability to provide realistic emergency flight procedure training. [FOF 94,95,109,110,204,205,279-283,366,367]

G. Local Airfield Procedures

38. The local arrival procedures are adequate and were not a factor in this mishap. Given NATOPS and OPNAV directives, the MP should have proceeded to NASNI, which would have precluded him from overflying a populated area. Irrespective of this particular mishap, there is a published approach to RWY 06 at Miramar, which has been used by emergency military and commercial aircraft in the past. When an emergency aircraft is returning to any airfield for landing, declaring an emergency gives the Pilot in Command the right and responsibility to deviate as necessary from established course rules in the interest of the safe conduct of the flight. In this case the MP had declared an emergency and was being vectored by approach control under instrument flight rules through a solid cloud deck in order to expedite his return to Miramar. [FOF 186,213,214 365]

H. Mishap Site

39. The mishap site was contained to a relatively small area, and all visible aircraft wreckage that didn't burn in the ensuing fire was recovered. The berm in the back yard of 4406 Huggins Street dissipated the majority of the fuselage momentum thus preventing likely damage to more houses. [FOF 311-339]

40. MCAS Miramar FD, ARFF, PMO, San Diego FD, and San Diego PD responded within a reasonable amount of time and worked in concert to fight the fires and secure the area according to established procedures. ARFF provided valuable information unique to military aircraft hazards but relied on MCAS FD communication assets to communicate with San Diego FD due to their lack of 800 megahertz radios. [FOF 340-364]

41. The impact of the aircraft directly caused the four fatalities. [FOF 311-329,340-342,349-357]

Recommendations

(A) Personnel

1. That the MP be subject to appropriate administrative sanctions for not adhering to NATOPS procedures and OPNAV directives during the MF, failing to pull out his PCL and read and execute each emergency procedure, and for exhibiting poor assertiveness, decision making, situational awareness, and judgment.

2. That the MS CO be relieved of command for cause.

3. That the MS OPSO be relieved of his duties as squadron Operations Officer and reassigned within the MAG.

4. That the MS AMO and MS MMCO receive no administrative action and remain in their billets.

5. That the MS ODO receive formal counseling.

(B) Operations

6. That 3d MAW submits a NATOPS change to review and modify the BINGO profile data for the F/A-18A-D aircraft to reconcile the descent and the need to maintain 85% rpm on the operating engine.

7. That 3d MAW submits a NATOPS change to the F/A-18 Single Engine Approach and Landing procedure to reconcile it with OPNAV 3710.7T guidance that a twin engine aircraft that has lost the operation of one engine will land at the nearest suitable airport.

8. That 3d MAW submits an F/A-18A-D NATOPS change to reconcile the difference between the NATOPS guidance for "land as soon as practical" single engine emergencies to match OPNAVINST 3710.7T guidance for a twin engine aircraft that has lost the operation of one engine.

9. That 3d MAW submits a request to upgrade the F/A-18 simulator's programming to properly duplicate the aircraft fuel system's closing of the feed tank fuel interconnect valve when crossbleeding an engine, and to allow the interconnect valve to open when the fire light is depressed.

10. That MCAS Miramar ARFF be funded to obtain 800 megahertz radios to communicate effectively with civilian fire fighters off base.

11. That 3d MAW recommend to Deputy Commandant for Aviation that all T/M/S squadrons implement and practice emergency scenarios to train duty officers and squadron personnel in how to effectively assist emergency aircraft and that this requirement be inspected separately from the squadron pre-mishap plan.

(C) Maintenance

12. That 3d MAW submits a request to NAVAIR to develop and maintain an F/A-18A-D MSP code criticality list, including a list of downing MSP codes.

13. That 3d MAW submits a request to NAVAIR to analyze and modify the work package A1-F18AE-460-210 for MSP codes 591 and 592, "L/R motive flow boost pump or boost pressure switch fail."

(b) (6), (b) (7)(C)